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complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Connection Diagrams
- Riser Diagrams
- Floor Plans
- Point-to-point Connections

SD-03 Product Data

Submit Manufacturer's Catalog Data for the following items:

- Amplifier
- Speakers (all types)
- Microphone
- Mixer
- Attenuator
- Transformer
- Wire
- Cabinets
- Racks

SD-10 Operation and Maintenance Data

- Operations and Maintenance Manual

SD-11 Closeout Submittals

- Connection Diagrams
- Riser Diagrams

Floor Plans
Point-to-point connections
Computer Generate Drawings
Hard Copy

1.3 QUALIFICATIONS

The manufacturer must be a company specializing in the manufacture of products specified in this section for a minimum of 3 years.

1.4 PRELIMINARY DRAWINGS

Submit [Connection diagrams](#), [riser diagrams](#), and [floor plans](#) indicating the relations and [point-to-point connections](#) (complete with actual terminal labels on terminal strips) of the following items by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, wiring, and other devices.

1.5 AS BUILT DRAWINGS

Submit connection diagrams, riser diagrams, and floor plans indicating the relations and point-to-point connections (complete with actual terminal labels on terminal strips) of the following items by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, wiring, and other devices.

Provide [1:100 1/8" - 1'-0"](#) scale drawings to indicate installed locations for all audio equipment, speakers and wiring. [Computer generate drawings](#) on size "F" sheets, using CAD software. Provide one [hard copy](#), and one electronic copy in ".DXF" or ".DWG" format. Obtain electronic files of the building floor plan from the Contracting Officer. Indicate locations of the following equipment/components:

- Amplifier
- Speakers (all types)
- Microphones
- Cabinets
- Racks

1.6 OPERATIONS AND MAINTENANCE MANUAL

Submit 6 copies of the Operation and Maintenance Manuals 30 days prior to testing. Update and resubmit data for final approval no later than 30 days prior to contract completion.

Operation and Maintenance Manuals must be consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Test data must be legible. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Bind pages for vendor data and manuals in 3-ring, loose-leaf binders. Data must be organized by separate index and tabbed sheets, in a loose-leaf binder. The binder must lie flat with printed sheets that are easy to read. Clearly label caution and warning indications.

1.7 DELIVERY, HANDLING, AND STORAGE

All equipment must be delivered, stored, handled, and installed in a manner that does not damage the equipment. Store equipment indoors in the

original unbroken, unopened containers bearing manufacturer's name, brand and UL label, in a clean, dry, and ventilated location.

During installation, protect equipment from the weather.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

General: The Paging and Area Warning system (P/AW) provides configurable zones for area warning; emergency, operational, and administrative paging; and alert capability for facilities at KSC. The system must amplify sound signals from cable plant low level lines and microphones, and distribute them to loud speakers at various locations.

The system must interface and be compatible with the KSC Paging and Area Warning system. The respective support contractor in the area of the project must make the final interfacing connection.

Functional Performance: Components and system features and functions must include but are not limited to the following:

- a. All Call Operation: Cable plant low level line input into the local facility paging system allowing area wide announcements to be broadcast by the KSC Duty Officer.
- b. Microphone Station: The microphone must normally be used as an input device to permit broadcasting a message throughout the facility.

2.2 EQUIPMENT AND MATERIALS

General:

- a. All equipment and materials must be new and approved by Underwriters Laboratories, Inc.
- b. Where 2 or more units of same class of equipment or materials are required, provide all units from single manufacturer.

2.2.1 Cabling

2.2.1.1 System Cabling

Cabling must be two conductor, twisted, shielded pair cables. Use plenum rated cable where cable is not installed in conduit.

Conductors must be stranded copper, 1 pair twisted, with copper drain wire. Where not installed in conduit, use cable suitable for plenum application; NEC rating CMP. Conductors from the amplifier to the attenuator panel must be No. 12 AWG. From the attenuator panel to the speaker, conductors must be No. 16 AWG. Microphone cable must be 2-pair, (one of the pairs must be shielded), No. 20 AWG. Cable must be rated 300 volts, with 90 degrees C temperature rating.

2.2.1.2 Hook-Up Wire

Conductors must be [20] [22] AWG, stranded, tinned copper, with aluminum polyester shield tape and tinned copper drain wire. Insulation must be

polyvinylchloride. Cable must be rated 300 volts, with 80 degrees C temperature rating.

2.2.2 System Audio Equipment

Size/rate all audio components to meet the requirements of, and be compatible with, the system as installed. Coordinate the system with the Contracting Officer and base support contractors, to ensure proper interface with the base-wide Paging and Area Warning System.

2.2.2.1 Power Amplifier

Power rating must be at <1 percent THD 50 Hz to 12 kHz; 70 volt balanced outputs. Frequency response must be +0/-3 dB, 20 Hz to 20 kHz. Provide high impedance balanced inputs for 200/600/1000 ohm resistance. Protection must be fail safe for output transistors. Input power must be 120 V AC.

The power amplifiers must be a modular card plug-in design with eight cards in each chassis. The chassis must be not more than 178mm 7 inches high and fit in a standard 483mm 19 inch rack. Each power amplifier card must have a 70 volt output with an efficiency of at least 80 percent at 200 watts output. Load each power amplifier card to no more than 80 percent of rated output (that is, 160 watts). The system power must be ample to drive speakers to 90 dB sound level.

2.2.2.2 Mixer-Amplifier

Accomplish mixing and distribution in the audio processing shelf. The audio processing shelf must accommodate at least 10 audio cards and must be not more than 89mm 3.5 inches high and fit in a standard 483mm 19 inch rack. Provide a test microphone for system testing at the paging rack in the communications room.

Amplifier must control and mix up to six (6) independent input signals, with up to +18 dBm output. Preamplifier microphone input module must be designed for use with balanced low impedance microphones. Nominal gain setting must be 40 dB for 100 mV rated output.

2.2.2.3 Attenuator (35 Watt)

Attenuator must be rated 35 watt. Attenuation per step must be 3 dB, with total attenuation at 30 dB. Insertion Loss must be 0.6 dB. Provide with a matte black polycarbonate dial scale overlay with adhesive backing and including skirted black knob.

Attenuators must be group mounted on aluminum plate in amplifier rack. Provide nameplate on each attenuator or identifying speaker group controlled.

2.2.2.4 Attenuator (75 Watt)

Attenuator must be rated 75 watt. Attenuation per step must be 3 dB, with total attenuation of 30 dB. Insertion Loss must be 0.6 dB. Provide with a matte black polycarbonate dial scale overlay.

Attenuators must be group mounted on aluminum plate in amplifier rack. Provide nameplate on each attenuator or identifying speaker group controlled.

2.2.2.5 Microphone

Microphone must be dynamic, with push-to-talk thumb switch and one set of dry contacts. Rated impedance must be (low) 150 to 200 ohms. Power level must be 58 dB re 1 mW/100 kilopascals - EIA sensitivity - 151 dB. Frequency response must be 100 to 8,000 Hz. Provide an XLR-5 male connector at the user end for connection to an interface box. Coil cord length must be 300 mm retracted, 1800 mm extended. Cable must be black neoprene, four conductor, (2 shielded) cable. Provide complete with mounting bracket. Maximum weight must be 255 grams [_____].

2.2.3 Speakers

2.2.3.1 Ceiling and Wall Mounted Speakers

Speaker assembly must include baffle-speaker-transformer, with wire volume control and enclosure. Transformer must be rated 70.7 volts with primary taps for 0.5, 1, 2, 4 watts. Provide adjustable volume control. Speaker must be 203 mm 8-inch in diameter, with power handling capacity magnet, 96 dB sensitivity at 1200mm and frequency response of 30 Hz - 15 Hz. Ceiling grille must be cold rolled steel with semi-gloss white enamel finish. Ceiling enclosure must be constructed of heavy gauge cold rolled steel with heavy undercoating and finish with rust preventive coating. Ceiling enclosure must be provided with mounting straps for attaching to supports of suspended ceiling. Wall speaker baffle must be finished wood construction, wedge shaped to direct sound downward, with mounting bracket and wall attachment.

2.2.3.2 Equipment Area and Exterior Wall Mounted Horns

Horns must be weatherproof fiberglass construction, with an adjustable "U" bracket for mounting. Loud speakers must be wide angled paging projector with extended range woofer and high frequency compression driver. Power handling capacity must be 15 watts with voice coil impedance of 8 ohms and produce sound pressure level of 117 dB at 1.2 m 4 feet with 15 watt input. Dispersion at 2000 Hz must be 66 degrees horizontal and 87 degrees vertical. Loud speaker assembly must include 70/25 transformer with tap settings at 15, 7.5, 3.8, 1.9, 1.0, and 0.5 watts.

2.2.4 Equipment Cabinets

Equipment cabinets must be constructed of 14 gauge CRS with 11 gauge CRS corner caster gussets, and 2 pairs of 14 gauge CRS adjustable mounting rails, zinc plated and punched 7 mm on EIA spacing. Cabinet depth must be 25 inches, vertical space must be 77.125 inches with mounting rails as required for all equipment installed. Frame must be finished in black. Base must accept leg levelers. Provide Racks with 16 gauge CRS perforated top panel. Rack must contain an 18 gauge CRS lift-off side panel, which has provisions for securing. Doors must be 16 gauge CRS mounted in 16 gauge CRS frame. CRS doors must include cylinder lock, handle and hinge left. Horizontal and vertical trim must be satin finish clear anodized aluminum. Single frame must sit on leg levelers. The front door must have Lexan panels (or approved equal) for equipment viewing without opening the door.

2.3 IDENTIFICATION LABELS

2.3.1 Equipment

Labels must be laminated plastic with black background and engraved white lettering in accordance with Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS. Permanently attach identification labels to front of electrical apparatus using sheet metal screws.

2.3.2 Cables

Cable labels must be a polyimide coated nylon cloth with a permanent acrylic pressure sensitive adhesive and a topcoat suitable for laser or write-on printing. Material must offer solvent and smudge resistance.

PART 3 EXECUTION

3.1 QUALIFICATIONS

The installer must be a company specializing in installing products specified in this section.

3.2 EXAMINATION

The Contracting Officer must examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Paging and Area Warning system work.

Do not proceed until unsatisfactory conditions have been corrected.

3.3 LAYOUT

Contract drawings indicate extent and general arrangement of systems and equipment.

Submit all requests for changes in layout due to structural features, equipment location, and similar conditions to the Contracting Officer.

3.4 INSTALLATION

3.4.1 General

Comply with National Electrical Code and regulations of local agencies having jurisdiction.

Install all equipment/components in accordance with manufacturer's instructions.

Provide raceway system under provisions of Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL of specification.

Ventilation and Cooling: Install central paging equipment in an environmentally controlled communications area. Install amplifiers in rack to provide adequate ventilation air flow over top and bottom of each amplifier.

3.4.2 Cable

Install in conduits or through conduit sleeves as shown on drawings. Install fire seal in conduit sleeves through walls after cables are installed.

Install all horizontal distribution plenum cable between communications room and speaker assemblies above drop tile ceiling spaces conforming to plans and specifications. Provide cable supports as required to prevent cable from lying on suspended ceiling, lighting, piping or ductwork.

Make terminations in an organized workmanlike manner by trained and qualified personnel. Terminate conductors with crimp type ring lugs. Terminate shields with shield ferrules and shield rings.

On projects where audio equipment is not provided in the construction contract, neatly coil the cable with appropriate labeling in the equipment cabinet for future termination. Route low level lines (microphone lines and low signal level lines) a minimum of 305-mm 12-in. away from 70 volt speaker lines and power lines.

3.4.3 Audio Equipment

Install all racks, cabinets, audio equipment, speakers, horns and all other system-specific equipment in accordance with plans and specifications. Securely mount to wall. There must be no more than ten (10) speakers on a single zone circuit.

Label all equipment with proper name and designation.

3.5 GROUNDING

Provide equipment grounding connections on paging and area warning system as indicated. Tighten connections to assure permanent and effective grounds.

Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide electrical service ground at main equipment locations. Measure, record, and report ground resistance.

3.6 FIELD QUALITY CONTROL AND TESTING

Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies that are observed in pre-testing. Replace malfunctioning or damaged items with new, and retest until materials satisfactory perform and conditions are achieved.

Testing: Upon completion of pre-testing, notify the Contracting Officer a minimum of 10 days in advance of acceptance test performance. Schedule and conduct tests in his presence. Provide a written record of test results.

Operational Test: Perform an operational system test to verify conformance of system to these Specifications. Perform tests that include originating program and page material at microphone outlets, all preamplifier program inputs, and all other inputs. Observe sound reproduction for proper volume levels and freedom from noise.

Acoustic Coverage Test: Feed pink noise into the system using octaves centered at 4,000 and 500 hertz. Use a sound level meter with octave band filters to measure the level at five locations in each zone. For spaces with seated audiences, the maximum permissible variation in level is plus or minus 2 dB and the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of speaker line matching transformers.

Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specification and complies with applicable standards. Provide a written record of all retest results.

Cable Tests:

After the system has been completely installed, remove each main 70V line shield one at a time from the single ground point and measure shield to ground resistance with a digital ohm meter and show a resistance of 10,000 ohms or greater. Record each reading on a data sheet and return the completed data sheet to the NASA contract engineer.

After the system has been completely installed, remove each 70V line, tip and ring, one at a time from the power amplifier and measure each conductor's resistance to ground with a digital ohm meter and show a resistance of 10,000 ohms or greater. Record each reading on a data sheet and return the completed data sheet to the NASA contract engineer.

After the system has been completely installed, remove each 70V line, tip and ring, one at a time from the power amplifier and measure the impedance between tip and ring with a 70V line impedance bridge, TOA model ZM-104 or equal, and show an impedance greater than the amplifier capability.

200 Watt amplifiers = Greater than 25 ohms total load.

150 Watt amplifiers = Greater than 33.3 ohms total load.

Record each reading on a data sheet and return the completed data sheet to the NASA Contracting Officer.

3.7 LABELING

3.7.1 Cabinets and Racks

Identify apparatus by specified name; for example "P/AW System Rack No. 1".

3.7.2 Terminal Strips

Letter and number on each terminal, for example "C1" through "C60", in sequence, top to bottom.

3.7.3 Speaker Attenuators

Letter and number each attenuator to identify associated speaker strings.

3.7.4 Cabling

Label all cables at each end with the zone or room number.

3.8 CLEANING AND PROTECTION

Prior to final acceptance, clean system components and protect form damage and deterioration.

-- End of Section --